ARTICLE II.

ON THE IMPORTANCE OF THE THOROUGH DISINFECTION OF THE STOOLS IN ENTERIC FEVER.

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THE importance of the thorough disinfection of the stools in enteric fever is, to those who believe in it at all, so great and its practical results in the control of the extension of the disease are so manifest and direct, that it will doubtless appear to such persons a superfluous labour to discuss the matter anew. I do not hesitate, however, to incur the criticism of needless writing upon a subject so familiar to many medical men actively engaged in the daily practice of their profession, for the reason that I observe that there are quite as many others to whom the subject appears to have no importance whatever. These latter, either do not believe in the necessity of the disinfection of enteric fever stools, or else they regard it as of so slight moment that it matters not practically whether it be attended to or not, or finally whilst professing to recognize its importance they adopt in practice imperfect, or incomplete, measures to accomplish it. I believe it to be the exception to the rule, rather than the rule, both in private practice and in hospitals, to systematically and thoroughly disinfect every stool, even in well-characterized cases of enteric fever. The cases in which, upon inquiry, I have found such a rule carried into effect, have been conspicuously few. Even those practitioners who fully realize the dangers attendant upon its neglect are not rarely prevented by circumstances from accomplishing all that they consider necessary. This may happen, for example, in imperfectly developed or atypical cases that are not easily recognized until well advanced, or in cases of true relapse not recognized because of the imperfect account of the primary sickness given by the patient or his friend; or, and this often occurs, by reason of the neglect of the attendants, who are slow to understand the danger of treating the stools in this disease with indifference, especially when they cherish the opinion that they, because they have nursed many cases of fever, know a good deal about it.

Liebermeister has well said that "prophylactic measures will be effective just in proportion to the strength of our belief in the material nature of the typhoid poison, and in the possibility of destroying it, or preventing its spread." And he adds that, "here, as elsewhere in therapeutics, half-way measures, such as are likely to be employed by those who have but little faith in their efficacy, yield not half-way results, but no results at all." For my own part, after some observation and much careful consideration of the matter, I confidently believe that it is not only possible to greatly restrict enteric fever in its prevalence, but that, as has been suggested by Flint, it is also possible in the course of time to get rid of it altogether. This statement is made with a full knowledge of the fact that this disease has a more extensive geographical distribution than any other zymotic disease whatever, and that it is not only at the present time endemic in almost every quarter of the globe, but that it is also the most common of the endemic infectious diseases in the countries where it prevails.

A growing knowledge of the habits of the exciting cause of enteric fever and of the methods by which the disease is propagated warrants this belief. It is certainly not more chimerical than would have been such a hope in the beginning of the seventeenth century, in regard to the plague; yet in little more than a century that disease had disappeared from Western Europe; nor than such a belief concerning smallpox in 1717, when Lady Wortley Montagu caused her son to be inoculated; yet to-day smallpox exists in civilized countries only by the neglect of the known means of its control. Could the surgeons of the Napoleonic campaigns have dared to predict that the greatest armies of modern history, both in Europe and America, would almost wholly escape the ravages of typhus? What an unsparing quarantine did with the plague in Europe; what vaccination has accomplished in the control of smallpox; what efficient sanitary regulations have brought to pass in preventing typhus fever in great armies—an energetic prophylaxis will assuredly accomplish with the great fever of the present.

Such a prophylaxis is in theory within reach; its practical realization depends upon the energy and steadfastness with which measures for the destruction of the true cause of the disease and the prevention of the spread of that cause are carried out. These measures are to be directly deduced from a consideration of knowledge concerning the causation of enteric fever, now so familiar as to be embraced by the term "popular." They belong to the general subject of public hygiene, and are of sufficient importance to demand the unremitting attention of all local and general sanitary organizations; for enteric fever destroys more lives that could be saved than any other acute disease whatever. They are, moreover, largely within the personal control of the physicians of every community. It is a duty of the doctor, too often overlooked, to see to it, that no preventable new case of disease arise by direct or indirect contagion from any patient under his care. In enteric fever, we have to do with a disease in which this is wholly possible. Our efforts to prevent further cases arising from the original source of infection may be often in vain, but the spread of the disease from any given patient is always, and absolutely, within our control. The cause of the disease cannot only be definitely and wholly destroyed, but this can be accomplished with certainty before it has acquired the power of infection.

The one efficient measure that includes all others, is the proper treatment of the dejections.

Up to the present time the exciting cause of enteric fever has eluded the attempts that have been made to demonstrate its nature. It is surely a micro-organism. Upon no other hypothesis can the known facts of the history of this and most of the other infectious diseases be explained. There is, moreover, abundant warrant for such a conclusion in the analogy of certain other diseases, notably anthrax and relapsing or spirillum fever. As it is, we are apparently upon the eve of more definite knowledge than has yet been attained. In 1880 was made the now familiar announcement of Eberth and Klebs, that they had discovered organisms in the tissues and fluids of patients dead of typhoid, that were not met with in like situations nor under like circumstances in the bodies of persons dead of other diseases. The researches of these observers were carried on separately and the announcement of the discovery of the organisms in question was made by each independently of the other, and nearly at the same time. There was a close correspondence in the descriptions, and each regarded the organisms described as essentially related to the cause of the disease.

A few months ago Maragliano, of Genoa, published an important note on the uniform occurrence of organisms in the blood of enteric fever patients during life. He found them both in the blood of the general circulation, and in that of the spleen, the latter being obtained by means of a hypodermic syringe the needle of which was passed through the abdominal wall into the substance of the organ. In the developed disease there are present in the blood isolated and grouped spherical bodies of a delicate contour, apparently homogeneous, resembling micrococci. Similar bodies were also found in the blood from the spleen, together with delicately outlined rod-shapen bodies corresponding in all particulars with those described by Eberth and Klebs. These bodies diminished in numbers as convalescence progressed, and none or very few were discovered in the blood of patients after large doses of quinine. By the method of fractional culture these organisms were reproduced in large numbers. Maragliano expresses no opinicn as to their relation to the disease.

These observations are very suggestive. They are nevertheless inconclusive. Although the organisms described may be cultivated, there is nothing to show that either the resulting product or the blood itself is capable of giving rise to the disease in suitable subjects, as has been shown to be the case by the experiments of Pasteur with anthrax and chicken cholera, and by those of H. Vandyke Carter, at Bombay, in producing relapsing fever in monkeys by inoculation.[1]

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[1] Dr. Almquist, of Stockholm, who has been working in this field, has cultivated bacteria taken from the blood of an enteric fever patient on the eleventh day, and succeeded in producing a series of generations. From the second generation he succeeded in inoculating a dog with the following result: the animal was hardly ill, but on the fifteenth day the Peyer's patches were found to be much swollen, and to contain bacteria, which were regarded as characteristic.—See *Med. Times and Gazette*, September 23, 1882.

It is also stated that M. Pasteur has succeeded in isolating the microbe of typhoid fever.—*Annales d'Hygiene publique*, September, 1882.

The difficulties in the way of the experimental investigation of this subject relate first to the almost complete absence of susceptibility to enteric fever on the part of the lower animals, and secondly, to the clinical fact that the stools do not possess at once upon being voided the power of infection, but only acquire it after undergoing certain altogether unknown changes outside the body.

Although the nature of the germ that gives rise to enteric fever is unknown, many facts in its natural history are established by abundant proof. Of these, the following have a direct bearing upon the subject of this paper:—

1. It is invariably derived from a previous case of enteric fever.
2. It is eliminated with the fecal discharges.
3. It is not capable of producing enteric fever at once in susceptible persons exposed to it, but must undergo changes outside the body before it acquires this power.
4. It retains its activity in favourable situations for a lengthened period, the requirements to this end being decomposing animal matter, especially fecal discharges, and moisture.
5. In such situations it is capable of reproducing itself.

These are the facts which indicate with singular directness the true measures necessary to prevent the spread of the disease, the efficient prophylaxis. These measures belong, for the most part, as I have said, to popular knowledge, and are beginning to be widely understood. That they fail of general acceptance is to be explained by two things: First, incredible as it is in the face of the accumulated knowledge upon the subject, there are still many persons regarded as professionally qualified to speak with authority upon such matters; and what is more, regarding themselves as qualified to do so, who look upon the germ theory of the infectious diseases as purely hypothetical, and who hold firmly to the view that typhoid fever, which they are inclined to consider a sort of "low nervous fever," may be caused by fear, sorrow, care, great fatigue, and so on, and therefore regard all measures of prophylaxis based upon the germ theory as a working hypothesis as vain.

Second, the pythogenic theory of the origin of enteric fever, introduced by Murchison and ingeniously defended by him and his followers, still holds its sway in the minds of many practitioners and teachers. The arguments in favour of this view and those against it are too familiar to detain us here. To Dr. William Budd, of Bristol, is due the credit of having first clearly pointed out and conclusively established the fact that no amount of filth of any kind can give rise to enteric fever in the absence of a previous case, or the dejections or soiled linen of a previous case. To turn back to his papers, in the light of our present definite knowledge of the specific cause of certain fevers, and especially with our present knowledge of the cause of relapsing fever, and read them as they appeared in *The Lancet*, at intervals between 1856 and 1860, has a curious effect upon the mind of the student of medical history. With all the work done since they appeared but little has been added to the sum of his information upon the subject of the propagation of the disease. It was he who spoke of the sewer as "a continuation of the diseased intestine." He abounds in strong expressions, happy illustrations and an impressive earnestness. That it has occasionally been impossible to trace the mode of conveyance of the "typhoid poison" in instances of the disease that have occurred in communities previously free from it, constitutes a very feeble argument against the view of the continuous propagation of the disease. It is easy to conceive of the unsuspected transportation of colonies of micro-organisms in many ways; not difficult to understand the occurrence of cases of enteric fever that cannot be traced, if the germs which occasion it are capable of a prolonged existence outside the body, and of this there is abundant and conclusive proof.

One thing Budd did not understand. He failed to recognize the fact that the stools are not infectious when voided, but must undergo changes which require a certain, though not very long, time before they are capable of giving rise to new cases. The failure to understand this has proved a stumbling-block alike to those who have regarded enteric fever as contagious, and those who have held to the opposite view. Both views are true. It is not directly but indirectly contagious. Cases are now and then observed which are at first sight apparently due to direct contagion, but which upon closer consideration are found to have been caused by the transmission of the diseases by indirect means.

Dr. Cayley, in his Croonian Lectures for 1880, relates the particulars of such a case:—

> "A boy was admitted into the Middlesex Hospital on March 27th, suffering from a very severe attack of typhoid. For several days he lay in an unconscious condition, and during this time he had very profuse diarrhœa—twelve to twenty liquid motions daily, which were for the most part passed in bed.
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> "In the next bed was a boy, aged six, who had been admitted on April 16th, with acute renal dropsy and bloody urine. He was kept strictly confined to bed, and never got up to go to the water-closet, down which the motions of the typhoid were thrown.
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> "On May 11th, when he was convalescing, the dropsy having disappeared, and the albumen much diminished, he was seized by typhoid fever, and passed through a moderately severe attack, with a small-marked rash and characteristic symptoms."

I have encountered a similar case: A man aged 20, was admitted to the hospital of the Jefferson Medical College, 28th October, 1881, with symptoms of subacute rheumatism, affecting several joints, and most severely the knees. A few days after admission, it was discovered that he was suffering from a purulent urethral discharge. The joint-pains which improved at first, afterwards proved stubborn; an iritis developed; there was complete loss of appetite, and great mental depression. In consequence of pain and inability to take food the patient fell into a state of great debility. He was, however, free from fever. When he had been in the ward more than four weeks the temperature rose and diarrhœa set in. In the course of a few days he became delirious, and some rose-coloured spots appeared. Death occurred six weeks after the patient's admission, and the necropsy disclosed characteristic typhoid infiltration of Peyer's patches, and the solitary glands with beginning ulceration.

In the next bed but one to that occupied by this patient, was a man suffering from relapse of enteric fever, whose illness had been greatly prolonged, and who, during the greater part of the time from the admission of the patient spoken of till his death, had copious diarrhœa and was only feebly conscious, so that despite the vigilance of the attendants, his bed and his person were frequently soiled with the discharges.

Cases of this kind are, however, rare. The attendants who wait upon the sick, and even remove and empty the vessels, the medical men, who are occasionally obliged to inspect the stools, and the patients in adjoining beds, who are of necessity exposed to the effluvium from the recent stools, as a rule, to which there are few exceptions, escape infection. When such exceptions occur, it is usually possible to trace the infection, as in the above cases, to exposure to the emanations from discharges that, soiling the linen, or soaking into the mattresses or otherwise retained, have undergone the changes of decomposition outside the body of the patients. Under ordinary circumstances the new cases that occur upon the importation of the disease into hospitals are not apt to arise among those persons immediately surrounding the patients; but rather if there be defects in the drainage, among others at a distance. The changes by which the dejections acquire this power of infection take place with greatest activity in drains, privies, and upon ground saturated with organic substances where the dejections are collected together.

We encounter at this point a question of the greatest practical importance. It is this: Within what time do the stools, innocuous when voided, develop their infecting properties? Definite facts upon which a positive reply to this question could be based are wanting. The time is, however, in all probability brief. Dr. Cayley states that in the Middlesex Hospital, it was formerly the custom to keep the stools of cases of enteric fever, which the physicians wished to inspect, in pans which were kept in the water-closets of the wards. The time during which these stools were kept rarely exceeded twelve hours; nevertheless several instances occurred in which the patients using these closets contracted the disease. If these reserved stools were the cause of the infection, the period within which the contagious properties became developed in them could not have been longer than twelve hours.

That the soiled linen, which when fresh may be handled by the attendants with impunity, speedily becomes capable of occasioning the disease, is shown by the frequency with which washerwomen suffer, for articles of this kind are usually sent to be washed without great loss of time. This manner of infection is attested by many unquestionable observations. That related by Dr. Cayley is very striking. It took place at Calne:—

> "A laundress occupied the middle one of a row of three houses supplied by one well, into which the slop of the laundress's house leaked. She on one occasion received the linen soiled by the discharges of a case of typhoid fever, and after fourteen days cases occurred in all three houses."

Dr. Budd's argument for the contagious character of enteric fever would have been unassailable if he had understood that the "special condition" of the communicability of the disease is the lapse of a few hours. At one point he says:—

> "To teach . . . . that the disease is not contagious, because the immediate attendants on the sick escape it, ... is much the same as to argue that because the next successors of the tuft of rushes that overhangs yonder river do not spring up immediately around their parent, the spores it has committed to the stream are sterile, and that it is not in the nature of rushes to multiply at all."

If the spores, instead of floating away to distant points, remain where they fall long enough to germinate, the next successors will be close at hand. The element of time is now known to be the "special condition." It is, therefore, impossible to overrate the importance of prompt measures to render the stools inert through disinfection by the use of "powerful chemical agents," and their removal to localities in which they are little likely to do harm. This is no new suggestion.

The following plan was suggested by Dr. Budd, who, from the time he adopted this method of prevention (till the publication of the paper referred to) met with only one instance, where it was used from the first, in which the disease spread beyond the individual first attacked, while before he adopted it, it was not an uncommon thing for him to see several members of a family take the disease, one after another, even in airy and well-appointed houses:[1]—

> 1. "That for the future all the discharges from the fever patient should be received on their issue from the body into vessels containing a concentrated solution of chloride of zinc.
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> 2. "That all tainted bed or body-linen should, immediately on its removal, be placed in water strongly impregnated with the same agent.
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> 3. "That the water-closets should be flooded several times a day with it, and that some chloride of lime should also be placed there, to serve as a source of chlorine in the gaseous form.
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> "And, lastly, and by way of further precaution, that so long as the fever lasted, the water-closets should be used exclusively as a receptacle for the discharges from the sick."

Liebermeister uses a porcelain bedpan, the bottom of which is strewn with sulphate of iron each time before being used. Immediately after the passage, crude muriatic acid is poured over the fecal mass in considerable quantities—as much as one-third to one-half of the amount of the discharges being used. He also advises that, when practicable, the contents of the bedpan should be emptied into trenches dug anew at short periods, and carefully filled up; care being taken that they are located at a distance from the source of water supply.[1]

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[1] The Fever at the Clergy Orphan Asylum. Lancet, Dec. 6, 1856.

Except in rural districts this is of course impossible, and the dejections must be emptied into the ordinary water-closets or privy-vaults.

Flint directs that carbolic acid in the proportion of one part to forty of water should be at once used for the purpose of disinfecting the stools. If the odour from this disinfective agent be objectionable, a concentrated solution of sulphate of iron may be substituted, of which half a pint may be poured upon each dejection, or a mixture of these two substances may be used.[2]

Bartholow says: "The dejections of a typhoid patient should be at once disinfected by a strong solution of sulphate of iron or chloride of zinc."[3] It has also been suggested that the stools be mixed with sawdust and burned.

Like rules are laid down in most of the modern text-books, with more or less emphasis, according to the strength of the belief of the respective authors "in the material nature of the typhoid poison, and the practicability of destroying it or preventing its spread."

From the time that enteric fever first assumed place as a substantive disease, differing pathologically and clinically from the others of the group of continuous fevers, two opinions were held, both in Great Britain and on the continent, concerning its contagiousness. It is worthy of note that the physicians of large cities, centres of medical authority, for the most part denied that the disease was communicable from the sick to the well; whilst those practising in the rural districts maintained its contagiousness, and from time to time published narratives of local outbreaks not otherwise explicable. Bretonneau, Chomel, Louis, all, however, inclined to the opinion that the disease was communicable. Trousseau, after citing a series of instances, declares that "the contagious nature of the disease is incontestable," and suggests, as an explanation of the fact that patients rarely contract the disease in hospital wards from others who have it, that the individuals who thus escape may have been rendered insusceptible by an attack at a former time. He adds the more general explanation that the energy of the *contagium* is less when cases occur sporadically than when typhoid fever prevails as an epidemic. These explanations are wholly inadequate, and have been set at naught by the facts brought to light by Budd.

Those who, prior to the time of the last-named observer, advocated the contagiousness of the disease, could suggest no measures of prophylaxis other than those employed to prevent the spread of the other contagious diseases, such as isolation, fumigation of the apartment, clothing, and so on. Measures such as these were seen to be wholly unnecessary when, by happy accident, the stools were well and quickly gotten rid of, and wholly useless when, by an unfortunate mischance, as often befell, especially in country places, the stools were treated with indifference. Thus it came to pass that a deplorable and dangerous uncertainty prevailed as to whether or not the disease was communicable. This uncertainty is now for the most part settled, though it would appear that a fear lest enteric fever may be directly contagious still exists in the minds of the Hygienic Council of the French Academy of Medicine, who have recently drawn up the following rules, to be observed "when the presence of typhoid fever is recognized":—

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[1] Ziemssen's Cyclopædia of Medicine.

[2] Clinical Medicine.

[3] Practice of Medicine.

> "1. *Isolation.*—The patient should be isolated as far as possible from the other inhabitants of the house; if complete isolation be not possible, the patient should be taken to a hospital. If the patient remain in his home, only those persons who minister to his wants should have access to his chamber, while all children should be rigidly excluded. Nurses should wash in carbolized water, one per cent.
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> "2. *Aeration of the Chamber.*—A room should be selected which can be readily aired. The hangings, curtains, and carpets should be removed, and the bed placed in the centre of the room.
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> "3. *Disinfection of the Evacuations.*—All the ejecta of the patient, before being thrown out, should be thoroughly disinfected with a solution of chloride of zinc, 20 per cent. The privies into which the evacuations are thrown should also be flushed with this solution.
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> "4. *Disinfection of Clothing.*—All the patient's body- and bed-clothing, before being removed from the room, should be plunged into a solution of carbolic acid, 5 per cent., and then immediately washed.
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> "5. *Disinfection of the Room.*—After the death or cure of the patient, charcoal should be burnt in the room, with sublimed sulphur, and the chamber should then be closed for twenty-four hours. The chamber should then be washed with carbolized water, and not reoccupied until it has been freely aired for at least a week."

If enteric fever be not directly but only indirectly communicable, and that by means of the dejections, several of these rules are unnecessary. It is with the stools, the vessels into which they are voided, the body-linen and bed-linen soiled with the discharges, and these alone, that we must concern ourselves in the matter of disinfection to prevent the spread of the disease. Plenty of fresh air, as little furniture as possible, no visitors or others in the room except those who take care of the patient, scrupulous cleanliness in all respects, are points to be insisted upon in the management of every case; but we must not lose sight of the real danger, nor by too great diligence in matters not essential, suffer our attention to be diverted from the one needful thing.

Every-day experience, both in hospital and general practice, shows how slight is the danger of the communication of the disease where the discharges are properly disposed of. This, and not, as Trousseau supposed, the greater energy of the cause, is the explanation of the comparative rarity of local epidemics in cities, their frequency in small villages and rural districts. In cities the discharges are, as a rule, promptly thrown into drains and more or less completely swept away; in the country they are apt to be deposited near the dwelling, and not only are they thus kept, but they are too often kept under circumstances the most favourable to the development of their infecting principles.

The literature of the subject abounds with lamentable illustrations of the dangers of the neglect to *completely disinfect* the stools when cases occur in the country, or under circumstances where it is impossible, through the lack of drainage, to effectually remove the dejections to a distance. But what is happening every day in cities in consequence of the neglect of disinfection? Is it enough that no new cases arise in the immediate vicinity of the patient? The drainage of our house is perfect, and by good fortune no particle of the treacherous filth is anywhere retained. Are we therefore to be unmindful of our neighbour, whose house-drains are far less safe than ours, imperfectly or perhaps not at all trapped and ventilated? Or of the dangers of the sewer inlets, or at some distant leak, where the sewage, soaking into the surrounding soil, may befoul a source of water supply, or where it only awaits the disturbances necessary for alterations or repairs to occasion fresh cases? Or, lastly, dare we ignore the fact that the crews of ships, lying in the rivers and harbours into which our great systems of sewers empty, contribute a steady supply of enteric fever cases of the most severe type to our hospitals? It occasionally happens, perhaps more frequently than we suspect, that the best house-drainage attainable fails of its object in some particular. Somewhere about the closet, in some joint or crevice, perhaps at the junction of the wood-work and the porcelain, an unobserved fleck of feces—the merest splash from the emptied bedpan—lodges and stays, retaining indefinitely or even affording a nidus for the development of its disease-producing microbes. In this way, when not in more obvious and coarser ways, such as choked soil-pipes, or leaks, or bad traps, or the dangerous old-fashioned pan closet, certain houses, a case once having occurred in them, become in a literal sense homes of enteric fever. There are typhoid houses, just as there are diphtheria houses, and for the same reasons.

Examples of such perennial centres of infection are far from rare. Murchison, among others, speaks of houses of this kind. I have recently met with several cases apparently due to continuous house-infection. I anticipate the objection that individuals dwelling in the same house may contract enteric fever at indefinite intervals as a mere coincidence, the infection being not continuous, but derived from altogether different sources. The *probability* of continuous house-infection is sufficiently strong for the purposes of the argument.

In a family of eight children, living in a large, well-built house, a son had enteric fever, and occupied, during his sickness and afterward, a room communicating with a bath-room in which there was also a water-closet. Enteric fever had not previously occurred in the family nor in the house. A year after his recovery the son gave up the room to a sister, who shortly afterwards contracted the disease. Thereupon the drainage of the bath-room was overhauled, "found defective," and rearranged. Nevertheless another daughter, who after several months came to share the room in question with the sister who had been ill, after repeated attacks of diarrhœa, had severe enteric fever.

Here the bath-room communicated directly with the sleeping-room; but in the two cases that follow an arrangement of the water-closet commonly looked upon as affording unusual security existed. At this point it may be stated that with properly trapped and ventilated soil-pipes, and a good supply of water the dangers from the sewer as to enteric fever are slight. It is from the house-side of the trap and the adjacent construction that, a case once having occurred, danger is to be feared.

A gentleman occupied a large airy room on the third floor of a spacious corner house in the heart of the city. In the autumn of 1881, he fell ill of enteric fever. The stools were thrown into a water-closet in the bath-room on the same floor. This bath-room does not communicate with any of the sleeping rooms, but being built in a sort of annex, is reached by a short hallway. The water-supply is good and the plumbing modern and in order. This year another gentleman, not having been exposed to any other traceable infection, and spending the most of his time in this house, using also this bath-room, has suffered, as I learn from his medical attendant, from an anomalous continued fever of considerable severity and long duration.

And another, yet more striking case:—

A gentleman of means, 38 years old, bought one of a row of houses in the course of building in a good neighbourhood. Desirous of securing the best drainage, he made such arrangements with the contractor in charge of the work as permitted him to take personal charge of the plumber's work in his house. Neither trouble nor expense was spared in the pursuit of this object. The details of the work were in accordance with the suggestions of an expert of repute. The bath-room communicating with his sleeping-room was provided with a tub and stationary washbasin only, the water-closet being in the back buildings and connected with the sewer by a separate system of pipes. A few months after moving into this house, its owner contracted enteric fever, of which he died in consequence of perforation of the bowel. Eighteen months later his widow, who had continued to occupy the house, suffered from an attack of enteric fever with characteristic symptoms.

Much more disastrous was the next instance:—

A family, consisting of a man and his wife, one daughter and several sons, all grown up, came to eastern Pennsylvania and bought an extensive tract of unimproved land upon the southern slope of a mountain of moderate elevation. Upon a portion of this land they built a large frame house as a general boarding-house and water-cure establishment. The nearest dwellings were a mile away, and the water supply, which was abundant for all purposes, was drawn from a spring some distance above the house on the hillside. The plumbing was arranged with judgment, and the surroundings were salubrious. The second year there came to the house in September, as a boarder, a lady, who, within a few days of her arrival, fell ill of enteric fever, of which she died. In the course of a few weeks the daughter and one of the sons had fever, and were sick a long time. The following summer two or three cases of fever occurred among the boarders. This reappearance of the disease led the owner to have his plumbing and drains examined by a competent person, who found no stoppage and no leaks. Nevertheless, such changes were made as would obviate, it was thought, every possible risk of infection from this source in the future. The next summer, four persons of whom I have knowledge contracted fever after some weeks' sojourn in this house. One of these died, and another, who was taken sick a few days before his return to Philadelphia, was under my care for six weeks with distinctly marked, mild enteric fever.

Efforts to trace the history of families, and of houses in which enteric fever has occurred, have, in my own practice, brought to light the above facts in the course of a few months. I am confident that similar investigations in a wider field would disclose a much more general evidence of continuous house-infection than is commonly suspected to exist. The limited number of cases, and the length of the intervals at which they occur are to be explained by the smallness of the amount of the infecting principle, rendering necessary, in all probability, an exposure of peculiar directness, or by the fact that a certain proportion of those exposed have been rendered insusceptible by a previous attack; or, finally, it is in a high degree probable that prolonged, incomplete exposure to the infecting principle of enteric fever may bring about in the individual a certain degree of tolerance—a sort of acclimation to an atmosphere sparsely charged with that poison.

To state the subject concisely, when a case of enteric fever arises from any source of infection whatever, there is great danger that it in turn will become the source of an indefinite number of other cases, a new focus of infection. The disease being propagated by means of the alvine discharges, two sets of persons are endangered by any particular case, those in the immediate vicinity, and those at a distance. The relative danger of near and remote infection is in rural and urban communities reversed in consequence of the different customs prevailing in each as regards the usual disposition of fecal discharges. In rural districts persons near at hand are particularly exposed, hence the frequency of local epidemics, whilst by the chance contamination of sources of water-supply, springs, running streams, or the transportation of dung for use as manure, persons at a distance may also become exposed, though much less frequently. In cities, however, the discharges being conveyed away by means of undergound sewers, subject more commonly those at a distance to the danger of infection. Nevertheless, we have seen that continuous house-infection may occur from the accidental retention of minute collections of the infecting principle on the house-side of the trap in the best attainable water-closets and sewer systems.

The importance of simple and effective sewerage, and of thoroughness in every detail of house-drainage, is to be urged at all hands with unremitting earnestness. But with reference to enteric fever safety does not lie in this direction. The danger to those near by and to those remote may be reduced to a minimum without regard to the imperfections inherent to the best plumber's work, by the systematic and thorough disinfection of the stools. When all the stools are completely disinfected immediately upon being voided, the danger that any given case will give rise to new cases becomes nil. To accomplish all that is possible in preventing the spread of enteric fever, the plan of complete and immediate disinfection must be systematically applied not only to the stools of the established cases, but also to those of cases that are beginning, that is to say, not only to the recognized but also to the suspected cases. In this way, and only in this way, can enteric fever be "stamped out."

The method of disinfection and the agent employed are of the utmost importance. There is little doubt that many of the measures commonly employed for this purpose are altogether inoperative; the disinfecting (germicide) power of many of the agents in common use is certainly feeble.

Koch has experimentally tested the ordinary disinfectants with the object of ascertaining (1), their respective power of destroying the resting-spores of bacilli, which are the most difficult of all forms of life to destroy; (2) their influence upon more easily destructible organisms, yeast, bacteria, bacilli, and micrococci; (3) their relative power of arresting the development of micro-organisms in alimentary beverages.[1]

He found that carbolic acid did not prove itself a sovereign disinfectant. It is worthy of note that solutions of this agent in oil and in alcohol are without effect in destroying the spores and bacilli of splenic fever. The same was the case with salicylic acid and thymol. Sulphurous acid also proved a very uncertain disinfectant for practical purposes. Zinc chloride, even in 5 per cent. solution, failed within a month to weaken the developing power of splenic fever spores.

Koch concludes that the only certain disinfectants are chlorine, bromine, and corrosive sublimate.

The results of these elaborate experiments may be found in the number of this Journal for October, 1882, page 581.

A series of experiments conducted by Arloing, Cornevin, and Thomas, at Lyons, with the object of testing the influence of various disinfecting agents upon morbific germs, resulted in placing corrosive sublimate at the head of the list of the efficient agents. The infecting principle of symptomatic anthrax was used, and a solution of 1 to 5000 was found to be capable of destroying the germs in the dried state.[2]

These results are in accordance with well-known facts—facts apparently better known, however, in the arts than in medicine. For example, solutions of corrosive sublimate are constantly used in households to destroy vermin, and it is well known that such solutions are employed by the taxidermists and furriers for the preservation of skins. Less known, perhaps, is their use by carriage-builders and hatters to prevent the development of moths in woollen fabrics. Corrosive sublimate is, however, much employed in the treatment of certain of the parasitic skin affections. It possesses also, to a high degree, the property of retarding putrefaction. "Animal matters, immersed in its solution, shrink, acquire firmness, assume a white colour, and become imputrescible. On account of this property it is usefully employed for preserving anatomical preparations." (Wood and Bache.)

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[1] Mittheil. der Kaiser Gesundh. 1881, Bd. X. Report der Analyt. Chemie, 1882, No. 1.

[2] Lyons Médicale. See also Abstract in Am. Journal Medical Sciences, October, 1882, p. 582.

I have satisfied myself by repeated experiment, that even weak solutions of corrosive sublimate possess the power of deodorizing putrescent animal substances to a degree not shown by most other substances in common use for the purpose, and I have of late used a solution of this agent 1 to 15000 to 1 to 5000 in washing out the chest cavity in cases of empyema with the effect of rapidly reducing the amount of purulent discharge.

In this preparation of mercury we possess at a very moderate cost a disinfectant of the highest efficiency. It is free from colour and odour, and in every respect convenient of employment. It is, furthermore, not only sure, but also rapid in its action. On theoretical and practical grounds alike, it is the disinfectant to be preferred for use in preventing the spread of enteric fever.

In practice 8.00 grammes (ʒij) of corrosive sublimate, taken to the house of the patient by the physician himself to avoid all risk of accidental poisoning, is to be dissolved in a gallon of water in a large bottle or demijohn. This vessel, properly labelled, is to be given in charge of the nurse. The strength of the solution is about 1 to 500 parts, and the danger of accidental poisoning is surely no greater than that attending a similar use of strong solutions of zinc chloride, carbolic acid, or any of the crude mineral acids.

Immediately after the bedpan has been used, a sufficient quantity of this solution should be poured over its fecal contents to cover them. This may be conveniently accomplished when the amount of the evacuation is small by inclining the pan so that its contents gravitate to the large end. If there be hard lumps, it is advisable to break them up in the solution. The pan should not be emptied for fifteen minutes. When using the water-closet the handle of the valve must be held up sufficiently long to thoroughly flush the trap, and a small quantity of the solution afterwards poured into the basin of the closet and allowed to remain. A small quantity is also to be kept in the bedpan in the intervals of its use.

The linen should be sprinkled with the solution before being sent to the laundry, and portions stained with the discharges must be thoroughly wet with it, or even allowed to soak a short time. As an additional precaution, the clothing should be boiled for some hours, and subjected to thorough rinsing (in running water whenever practicable) before being handled by the washerwoman.

ARTICLE III.

CASES OF "MUSHROOM POISONING." By JAS. D. TRASK, M.D., of Astoria, New York.

DURING an absence from home, last autumn, two reports of cases of death from eating poisonous fungi having met my eye in the columns of a country paper, I determined to obtain all the particulars possible in connection with them.

The first occurred in the family of Mr. G. E. Everett, residing near Modena, Ulster Co., N. Y., the family consisting of the father, mother, grandmother, daughter of fifteen, and a son aged thirteen. On visiting Modena the following particulars were obtained from Dr. Parker, who attended the family, and also from the surviving members:—

On the morning of Saturday, Sept. 23d, the father had gathered an edible mushroom (*Agaricus campestris*) from the grass before the door, which had been cooked by the grandmother, and tasted with great relish by several of the family. As the grandmother professed to be able to distinguish the wholesome from the poisonous, the father and son determined to gather a mess for dinner. A basketful was brought home, of which a considerable portion had been found in the woods. They were culled over by the grandmother, and, in what proved to be her absolute want of experience, she is believed even to have rejected some that were undoubtedly edible. They were served at dinner; those who had eaten the campestris in the morning, declaring that these had a different taste from it, the flavour being earthy and uninviting. Condiments were added to improve the taste. Not over a quart of the fungi was cooked. The wife ate not more than a *teaspoonful* of the *liquid*, the boy ate, perhaps, two fungi. At their evening meal, what had been left at noon was re-served and tasted by the father and grandmother and boy, but they found them still uninviting. The boy complained of malaise at supper time, and soon after going to bed was seized with vomiting and purging. At midnight the grandmother was attacked in the same manner, and by 2 A. M. the entire number was suffering from urgent vomiting, diarrhœa, and cramps, no one being able to render assistance to the rest, nor to go for help. About 5 A. M. the boy succeeded in reaching a house a quarter of a mile distant, and the doctor was sent for.

On the doctor's arrival he found the vomiting and purging almost incessant, accompanied by excessive burning in the stomach, cramps of the arms, legs, and walls of the abdomen. Nausea continued with the grandmother until Monday evening, a short time before her death, which occurred at 8 P. M.